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IS 8018 (1976): Platinum and platinum alloy wires for thermocouples elements [ETD 18: Industrial Process Measurement and Control]



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IS : 8018 - 1976

Indian Standard

SPECIFICATION FOR
PLATINUM AND PLATINUM ALLOY WIRES
FOR THERMOCOUPLE ELEMENTS

UDC 669.231.426 [621.362]



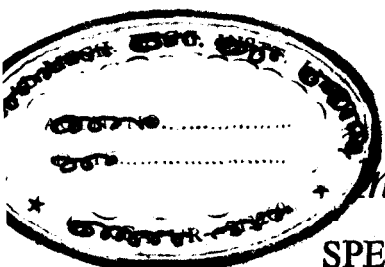
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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

SPECIFICATION FOR PLATINUM AND PLATINUM ALLOY WIRES FOR THERMOCOUPLE ELEMENTS

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Indian Standard

SPECIFICATION FOR PLATINUM AND PLATINUM ALLOY WIRES FOR THERMOCOUPLE ELEMENTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 2 March 1976, after the draft finalized by the Electrical Instruments for Industrial Processes Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Platinum and platinum alloy wires are used in the manufacture of rare metal thermocouples. This standard has been brought out to cover detailed requirements, such as materials, dimensions, thermo-emf, finish and tests for such wires. The requirements and tests for the complete thermocouple are covered in IS : 7358-1974*.

0.3 In the preparation of this standard, considerable assistance has been derived from ILS : 64-1974 'Plant standard — Thermocouple elements' issued by the Instrumentation Ltd, Kota.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements and the methods of test for platinum/rhodium alloy wires and platinum wires used as elements of the thermocouples.

*Specification for thermocouples.

†Rules for rounding off numerical values (*revised*).

2. DESIGNATION

2.1 The thermocouple wires conforming to this standard shall be designated in the following manner:

Examples:

- a) A wire of 0.5 mm diameter containing 90 percent platinum and 10 percent rhodium shall be designated as,

Pt/10% Rh, ϕ 0.5 IS : 8018-1976

- b) A wire of 0.5 mm diameter containing 100 percent platinum shall be designated as,

Pt, ϕ 0.5 IS : 8018-1976.

3. MATERIALS

3.1 The platinum/rhodium alloy wire shall be made from chemically pure platinum, having resistance ratio $\frac{R_{100}}{R_0}$ not less than 1.391 in annealed condition, and technically pure rhodium with minimum 99.90 percent rhodium content.

NOTE — R_{100} refers to resistance of the wire specimen at 100°C, and R_0 refers to resistance of the wire specimen at 0°C.

3.2 The platinum wire shall be made from chemically pure platinum having resistance ratio $\frac{R_{100}}{R_0}$ not less than 1.391 in annealed condition. (see Note under 3.1).

4. DIMENSIONS

4.1 The diameters and tolerances of the wires shall be chosen from the following (see IS : 6683-1973*).

<i>Nominal Diameter</i>	<i>Tolerance</i>
mm	mm
0.35 } 0.40 } 0.45 }	± 0.008
0.50	± 0.01

*Diameters for wires of platinum group metals and their alloys.

5. THERMO-EMF

5.1 The thermo-emf of the paired wires shall correspond to the following Indian Standards within the permissible deviation given below:

Paired Wires		Indian Standard	Temperature Range °C	Permissible Deviation
Positive Element	Negative Element			
Pt/10% Rh	Pt }	IS : 2055-1962*	0 to 600	±3°C
Pt/13% Rh	Pt }			
Pt/30% Rh	Pt/6% Rh	IS : 6720-1972†	Above 600	±0.5% of the measured value

6. FINISH

6.1 The surface of the wire shall be clean, smooth, free from scales, cracks, laminations, burrs, scratches and lines.

NOTE — However, nonperceptible scratches, dents, lines, temper colour and dullness due to heat treatment shall be permissible.

7. SUPPLY OF MATERIAL

7.1 The wires shall be supplied in annealed condition in the form of paired coils.

7.1.1 The difference in length of wire contained in the two paired coils shall be not more than 200 mm.

7.2 Coils of wire shall be uniformly and tightly wound without intermixing of turns and bound at two places with the ends of the same wire.

8. MARKING

8.1 The following details shall be indicated on a tag attached to each coil:

- Manufacturer's name or trade-mark;
- Nomenclature of the metal or alloy;
- Diameter of wire;
- Length of wire in the coil;
- Net mass of wire in the coil;
- Manufacturer's identification number for the coil; and
- Nomenclature and manufacturer's identification number of the pairing coil which is to be used for the other element of the thermocouple.

*Reference tables for platinum/rhodium-platinum thermocouples.

†Reference tables for platinum/30 percent rhodium-platinum/6 percent rhodium thermocouples.

8.1.1 Each tag may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

9. PACKING

9.1 Each coil shall be wrapped in a soft paper and placed in a suitable container alongwith the pairing coil. All such containers shall be packed in wooden or metallic box suitable to withstand transit hazards.

10. TESTS

10.1 Classification

10.1.1 Type Tests — The following shall constitute the type tests:

- a) Visual examination (**10.2**),
- b) Dimensions (**10.3**),
- c) Resistance ratio (**10.4**),
- d) Thermo-emf (**10.5**),
- e) Annealing (**10.6**), and
- f) Homogeneity (**10.7**).

10.1.1.1 Number of samples and criteria for conformity — Type tests shall be applied to three test specimens of suitable lengths taken from three coils. In the event of any one specimen failing to comply with the requirements in any respect, a further set of three specimens from three different coils shall be taken, all of which shall comply with the requirements of this standard.

10.1.2 Acceptance Tests — The following shall constitute the acceptance tests:

- a) Visual examination (**10.2**),
- b) Dimensions (**10.3**),
- c) Resistance ratio (**10.4**), and
- d) Thermo-emf (**10.5**).

10.1.2.1 Recommended sampling plan for acceptance of lot — A recommended sampling plan and criteria for acceptance of lot is given in Appendix A.

10.1.3 Routine Tests — The following shall constitute the routine tests:

- a) Visual examination (10.2), and
- b) Dimensions (10.3).

10.2 Visual Examination — The external appearance and finish shall be checked without using any magnifying device for compliance with 6.

10.3 Dimensions — Each coil shall be checked for diameter and ovality of wire at three different places along the length of the wire. A suitable device of the required accuracy of measurement shall be used.

10.3.1 The ovality shall be not more than the tolerance specified in 4.1.

10.4 Resistance Ratio — For checking the resistance ratio, $\frac{R_{100}}{R_0}$ of the thermocouple wires, one test specimen each of 2 m length shall be taken from each sample coil.

10.4.1 The value of $\frac{R_{100}}{R_0}$ in annealed conditions is checked on the actual test specimen of wire drawn from a sample coil.

10.4.2 For the determination of $\frac{R_{100}}{R_0}$ for the test specimen of the thermocouple wires, the values of R_{100} and R_0 shall be measured by a device having a minimum accuracy of 0.0001 Ω .

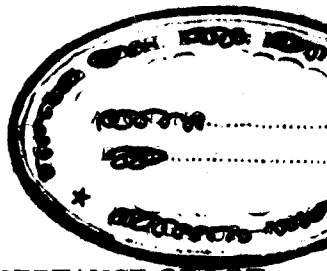
10.5 Thermo-emf — The thermo-emf shall be checked by employing a device having an accuracy $\pm 1 \mu\text{V}$ or better.

10.6 Annealing — The completeness of annealing is checked by annealing for 10 minutes the sample wires of platinum/rhodium alloy and platinum at $1\,200 \pm 20^\circ\text{C}$ and $1\,000 \pm 20^\circ\text{C}$ respectively and then checking the value of thermo-emf at $1\,200 \pm 20^\circ\text{C}$ in a pair with the standard reference which should not differ compared to the value before annealing by more than $7 \mu\text{V}$ for platinum wires, and $10 \mu\text{V}$ for platinum/rhodium alloy wires.

10.7 Homogeneity — Under consideration.

APPENDIX A

(Clause 10.1.2.1)



RECOMMENDED SAMPLING PLAN FOR ACCEPTANCE OF LOT

A-1. LOT

A-1.1 In any consignment, all the wires of the same kind and manufactured under similar conditions shall be grouped together to constitute a lot.

A-1.2 Samples shall be taken from each lot and tested for acceptance tests.

A-2. SCALE OF SAMPLING

A-2.1 The number of sample coils to be selected shall be in accordance with col 1 and 2 of Table 1.

TABLE 1 SCALE OF SAMPLING						
NUMBER OF COILS IN THE LOT	FIRST STAGE SAMPLE	SECOND STAGE SAMPLE	$N_1 + N_2$	C_1	C_2	C_3
N	N_1	N_2				
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 300	8	8	16	0	2	2
300 „ 500	13	13	26	0	3	4
501 „ 1 000	20	20	40	1	4	5
1 001 and above	32	32	64	2	5	7

A-2.1.1 The coils shall be selected at random from each lot. For this purpose, provisions for random sampling given in IS : 4905-1968* shall be adopted.

A-3. NUMBER OF TESTS AND CRITERIA FOR ACCEPTANCE

A-3.1 Each of the coils selected in the first stage in accordance with col 1 and 2 of Table 1 shall be tested for acceptance tests. For this purpose adequate length of test specimen shall be cut from each of the selected coil. In case a test specimen fails in any one of the acceptance tests, the respective coil shall be called a defective coil. If the number of defectives is less than or equal to C_1 , the lot shall be considered as conforming to the acceptance tests. If the number of defectives is equal to or greater than C_2 , the lot shall be considered as not conforming to acceptance tests. If the number of defectives in the first stage is between C_1 and C_2 , a further sample of same size as taken in the first stage shall be taken and tested. If the number of defectives in the two samples combined is less than C_3 the lot shall be considered as conforming to the requirements of acceptance tests, otherwise the lot shall be considered as not conforming to acceptance tests.

*Methods for random sampling.